

# A taxonomic revision of *Calycopeplus* Planch. (Euphorbiaceae)

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## Summary

Forster, Paul I. (1995). A taxonomic revision of *Calycopeplus* Planch. (Euphorbiaceae). *Austrobaileya* 4(3): 417–428. The endemic Australian genus *Calycopeplus* Planch. is revised. Five species are recognised, *C. casuarinoides* L.S.Sm., *C. collinus* P.I.Forst. sp. nov., *C. oligandrus* P.I.Forst. sp. nov., *C. paucifolius* (Klotzsch) Baill. and *C. marginatus* Benth. All species are described and illustrated and notes are provided on their distribution, habitat, typification and conservation status.

Keywords: Euphorbiaceae, *Calycopeplus casuarinoides*, *Calycopeplus collinus*, *Calycopeplus oligandrus*, *Calycopeplus paucifolius*, *Calycopeplus marginatus*.

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## Introduction

The genus *Calycopeplus* was described by Planchon (1861) with the single species *C. ephedroides* Planch. from south-western Western Australia. Boisser (1862) united the then monotypic genus with the pantropical *Euphorbia* L. as *E.* section *Calycopeplus* (Planch.) Boiss.; however, Baillon (1866) and later Bentham (1873) supported acceptance of *Calycopeplus* as a distinct genus. Bentham (1873) added a second species, *C. marginatus* Benth. from south-western Western Australia, but no further research on the genus occurred until Smith (1969) described *C. casuarinoides* L.S.Sm. from north Queensland. This latter name has been applied to plants that occurred both in north Queensland and also in tropical areas of the Northern Territory and Western Australia (Hassall 1977; Lazarides *et al.* 1988; Dunlop 1989; Wheeler 1992).

*C. ephedroides* was considered conspecific with *Euphorbia paucifolius* Klotzsch by Baillon (1866) who therefore, made the combination *C. paucifolius*. Both these names appear in recent floras (e.g. Weber 1986, Wheeler 1987) where the number of species is given as three or four.

*Calycopeplus* quite clearly belongs in the tribe Euphorbieae Pax & Hoffm. of the subfamily Euphorbioideae. Its relationship to

other genera within the tribe is unclear and a rigorous, objective classification of the eleven genera involved is long overdue (Gilbert 1994). Both Croizat (1937) and Webster (1967) suggested relationships or homologies between *Calycopeplus* and different taxa of *Euphorbia* from geographically distant places such as Africa and Peru, but these comparisons have been made on limited information mainly relating to floral arrangement. Webster (1994) included *Calycopeplus* in the subtribe Neoguillauminiinae Croiz. with *Neoguillauminia* Croiz. Taxa of this subtribe differ from those in the other two subtribes of Euphorbieae (Anthosteminae (Baill.) Webster and Euphorbiinae), primarily in the pseudopetals of the cyathia developing from involucre bracts rather than from the interbracteal glands. *Neoguillauminia* is monotypic and endemic to New Caledonia and differs from *Calycopeplus* in the alternate, well-developed foliage, petaloid involucre and 8 or 10 cyathial glands (McPherson & Trel 1987; Webster 1994).

Taxa of *Calycopeplus* are superficially similar to many taxa of *Euphorbia*, particularly the aphyllous species (e.g. *E. sarcostemmoides* J.H. Willis; Forster 1987). *Calycopeplus* may be differentiated from *Euphorbia* by the involucre glands without appendages and the male flowers being arranged in 4 groups of 3–16 individual flowers, each group of flowers being subtended by floral bracts (calyculate). *Euphorbia* in comparison has involucre glands

with appendages, does not have the male flowers arranged in 4 groups, and the flowers are not calyculate.

No modern revision of *Calycopeplus* exists that takes into consideration all of the published names. It is apparent that some names have been misapplied (e.g. *C. casuarinoides* in the Northern Territory and Western Australia), and new, undescribed species are present. The current paper provides a revision of *Calycopeplus* based on morphological data, prior to an account in the 'Flora of Australia' Vol. 23.

As noted by Hassall (1977), *Calycopeplus* consists of small shrubs or trees that are 'ephedroid' in appearance, i.e. they appear leafless and the primary photosynthetic organs are the rounded or flattened stems. This ephedroid habit was considered by Hassall to be adaptive towards periodic drought, although the mechanisms for this remain uninvestigated. Beard (1990) commented on the "succulent shrub *Calycopeplus ephedroides*", but the stems in the taxon concerned are not truly succulent and his comment may result from a casual comparison of it with superficially similar Australian plants such as *Euphorbia sarcostemmoides* (Forster 1987) or *Sarcostemma* (Asclepiadaceae) (Forster 1992) where the aphyllous stems do possess water storage tissue. Rather, the photosynthetic stems of *Calycopeplus* are somewhat woody, and dried specimens show a rigid structure and obvious areas of woody support tissue. Major wood and bark development occurs only in the small tree *C. casuarinoides* from Cape York Peninsula, whereas the other four species remain as small shrubs or subshrubs. At least one species, *C. collinus* from the Northern Territory and northern Western Australia, is thought to be short lived (less than 5 years), but there is little published phenological and ecological information for the three species from south-western Western Australia.

### Materials and Methods

This revision is based on herbarium collections at AD, BRI, CANB, CBG, DNA, MEL, NSW, PERTH and QRS, type collections at K and LD, microfiche of specimens at G–DC, and my own

collections and field observations in the Northern Territory and Queensland.

### Terminology

The GRIDCELLS format follows the simple procedure whereby if the taxon is recorded, for example, from the 1° grid cell 29°00'S to 29°59'S latitude, 114°00'E to 114°59'E longitude, then its GRIDCELL is recorded as 29114. Thus distribution of a given taxon may be quickly ascertained at the continental scale enabling significant distributional records (i.e. occurrences in additional grid cells) to be easily determined.

Conservation codings are proposed using the system of Briggs & Leigh (1988).

### Taxonomy

**Calycopeplus** Planch., Bull. Soc. Bot. France 8: 30 (1861). **Type:** *Calycopeplus ephedroides* Planch.

**Derivation of name:** From the Greek *kalyx* (calyx) and the Latin *peplus* (a robe of state), alluding to the involucre resembling a collective calyx.

Trees, shrubs or undershrubs, evergreen, perennial, monoecious. Stems virgate, cylindrical, ridged or complanate, with white latex, becoming woody with age; bark smooth, or fissured and tessellated in one species. Stipules absent or if present then entire, inconspicuous and deciduous. Leaves opposite, ± sessile, linear, linear-lanceolate or oblanceolate, elobate, penninerved, entire, eglandular or glandular. Inflorescences axillary, pedunculate, pseudanthial with 1 or 2 involucre per axil, 2-bracteate. Involucres (cyathia) campanulate and resembling a calyx, 4-lobed and with small glands alternating between the lobes. Male flowers arranged in 4 clusters of 3–16 within the involucre and opposite its lobes, each cluster subtended and more or less embraced by bracts, the outer 1 or 2 much enlarged and enclosing the cluster; flowers each consisting of a single pedicellate stamen, with a well-marked articulation between pedicel and filament, and lacking a perianth; filaments filiform to somewhat flattened; anthers

dorsifixed, bilobate, thecae oblong and longitudinally dehiscent. Female flower solitary in the centre of the involucre, pedicellate, with a 4- or 6-lobed perianth (or involucre); ovary sessile or shortly pedicellate, 2 or 3-locular, ovules uniloculate; styles 2 or 3, shortly connate, shortly bifid. Fruits capsular, trilobate,

smooth, dehiscent into 3 bivalved cocci. Seeds oblong to subglobose-obloid; testa crustaceous; albumen fleshy; caruncles entire; cotyledons broad, flat.

Endemic to Australia, with five species.

### Key to species of *Calycopeplus*

1. Stems 2-angular in cross-section, longitudinally complanate . . . . . **4. C. marginatus**  
Stems 6-angular or round in cross-section, longitudinally ridged or cylindrical . . . . . 2
2. Stems round in cross-section, longitudinally cylindrical . . . . . **3. C. paucifolius**  
Stems 6-angular in cross-section, longitudinally ridged . . . . . 3
3. Small trees developing black tessellated bark; involucre glands larger and longer than involucre lobes . . . . . **1. C. casuarinoides**  
Shrubs or subshrubs not developing bark; involucre glands shorter and smaller than involucre lobes . . . . . 4
4. Involucre lobes broad-triangular, 0.8–1 mm long, c. 2 mm wide; glands < 0.5 mm long; male flowers in groups of 2 or 3; anthers 0.7–0.9 mm long . . . . . **5. C. oligandrus**  
Involucre lobes triangular, 1–2.2 mm long, 0.8–2 mm wide; glands > 0.5 mm long; male flowers in groups of 5–14; anthers 0.4–0.6 mm long . . . . . **2. C. collinus**

**1. *Calycopeplus casuarinoides*** L.S.Sm., Contrib. Queensland Herb. 6: 4 (1969).  
**Type:** Queensland. COOK DISTRICT: Aurukun Mission, near Archer River mouth, 21 Feb 1964, *W.F. Mackenzie* [AQ342460] (holo: BRI).

*Ephedra arborea* F.Muell. ex Parlatore in A.D.C., Prodr. 16(2): 360 (1868), **nomen nudum**. **Type:** Queensland. COOK DISTRICT: Foot of Newcastle Range, Apr 1857, *F. Mueller* (holo: G-DC [fiche at BRI]).

Shrub or small tree to 10 m high, long-lived. Bark well-developed with age, black, fissured and tessellated. Stems 6-angular in cross-section, longitudinally ridged; internodes 10–100 mm long, 1–3 mm diameter on upper branches; red 'fruit-like' galls often present at nodes. Stipules absent. Leaves linear, 1.5–20 mm long, 0.5–1.6 mm wide, concolorous, glabrous, eglandular. Inflorescences with peduncles 1–1.5 mm long, generally with a

single involucre; bracts ovate-triangular, 1–2 mm long, 0.8–1.8 mm wide, glabrous. Involucres campanulate, 1.5–2.2 mm long, 2.2–3 mm diameter, glabrous, generally with male and female flowers together in same involucre; lobes ovate-truncate, 0.7–1 mm long, 1.2–1.5 mm wide, entire, shorter than glands; glands ellipsoid-spherical, 1.4–1.8 mm long, 1.8–2 mm wide, clearly visible between lobes and inserted on involucre at same level as lobes. Male flowers in clusters of 4–9 flowers; bracts 3, oblanceolate, 2–2.5 mm long, 0.8–1 mm wide, ± free or somewhat fused, shortly ciliate on tips for 0.2 mm; pedicels flattened-terete, 1–6 mm long, c. 0.2 mm diameter; filaments flattened-terete, 0.5–1 mm long, 0.1–0.2 mm diameter; anthers c. 0.5 mm long, 0.6–0.7 mm wide. Female flowers with pedicels to 1 mm long; perianth segments 4, oblanceolate, 0.8–1.2 mm long, 0.5–0.7 mm wide, glabrous; ovary sessile, c. 0.8 mm long and 0.8 mm wide, glabrous; styles 3, erect to slightly recurved, 0.7–0.8 mm long, shortly connate for 0.2–0.5 mm at base, tips distally bifid for c. 0.2 mm of

their length. Fruit  $\pm$  globose, 4–4.5 mm long, 4–4.5 mm diameter. Seed obloid, 2.5–3 mm long, 1.8–2 mm wide, pale yellow-tan; caruncle pyramidal, c. 0.4 mm long and 0.7 mm wide, pale yellow. **Fig. 1A–H.**

**Selected specimens examined: Queensland.** Cook DISTRICT: Cape York, N of Jardine River, c. 29 km S of Bamaga, 11°09'S, 142°22'E, Oct 1971, *Dodson* [AQ003636] (BRI); Jardine River, May 1948, *Brass* 18883 (BRI); Road to Pennefather, 12°20'S, 141°53'E, Jul 1988, *Dalliston* CC266 (BRI); Sandy Creek, Weipa to Stones Crossing road, 69 km from Weipa, 12°25'S, 142°10'E, Jul 1993, *Forster* 13501 *et al.* (BRI, QRS); Botchet Swamp, 18 km NNW of Lorim Point, Weipa, 12°31'S, 141°48'E, Mar 1981, *Morton* 1154 (BRI, MEL); 15 km N of Batavia Downs on the Peninsula Development road, 12°31'S, 142°39'E, Apr 1990, *Clarkson* 8459 & *Neldner* (BRI, DNA, MBA, QRS); Weipa concession, Willum Swamp, 12°40'S, 142°00'E, Sep 1974, *Dockrill* 863 (BRI, CANB, QRS); 62.5 km along main Weipa road, off Peninsula road, 12°56'S, 142°24'E, Apr 1988, *Forster* 4068 & *Liddle* (BRI); Embley Range, 13 km SSW of the Batavia Downs Homestead, Jul 1985, *Clarkson* 6065 (BRI, MBA); Archer River, 13°25'S, 142°10'E, Sep 1974, *Hyland* 7573 (BRI, QRS); 60 km W of Strathmay on Musgrave to Edward River road, 14°42'S, 142°18'E, Oct 1980, *Clarkson* 3494 (BRI, DNA, MBA, QRS); 2 km S of Hann River Crossing, c. 70 km NW of Laura, Apr 1976, *Hassall* 7613 (BRI); near Lakes Creek, c. 21 miles [35 km] SE of Hann River crossing on Laura - Coen road, Oct 1962, *Smith* 12041 (BRI); 47 miles NW of Laura, 15°15'S, 144°00'E, Jun 1971, *Hyland* 5192 (BRI, QRS); near Normanby River, north of Kalpowar, 14°45'S, 144°15'E, Oct 1970, *Hyland* 4869 (BRI, QRS); 47 miles [78.3 km] NW of Laura, 15°15'S, 144°00'E, Jun 1971, *Hyland* 5192 (BRI, QRS); Kowanyama Aboriginal Reserve 8.3 km from Shelfa crossing of Mitchell River, on track from Kowanyama via Yalko yards, 15°23'S, 141°53'E, Aug 1980, *Clarkson* 3360 (BRI, QRS); beside Dorunda Lake Homestead, 16°32'S, 141°49'E, Jun 1990, *Neldner* 2940 & *Clarkson* (BRI, CANB, MBA); Wyaaba Creek, 16°45'S, 142°00'E, Aug 1936, *Blake* 12554 (BRI, CANB).

**Distribution and habitat:** GRIDCELLS: 11142, 12141, 12142, 12143, 13141, 13142, 13143, 14141, 14142, 14144, 15141, 15143, 15144, 16142. *Calycopeplus casuarinoides* is restricted to Queensland and occurs sporadically over most of western Cape York Peninsula and is also probably throughout much of the country bordering the Gulf of Carpentaria (**Map 1**). Plants grow in seasonally inundated eucalypt or melaleuca open woodlands often dominated by *Eucalyptus microtheca* F. Muell. and *Melaleuca viridiflora* Sol. ex Gaertn. and ephemeral swamps.

**Notes:** *Ephedra arborea* was first mentioned in the literature by Mueller (1862) as a *nomen*

*nudum* in his list of plants collected on the Landsborough expedition to the Gulf of Carpentaria while looking for the ill-fated Burke and Wills. The name was subsequently listed under species dubiae in Parlatores's (1868) account of *Ephedra* with the brief statement "In Nova Hollandia orientali, Newcastle Range (Ferd. Mueller). Possideo Tantum ramos qui insigniter sulcati." The specimen in G–DC has "Foot of Newcastle Range, Apr 1857 F v Mueller". Both Bentham (1873) and Smith (1969) mentioned *E. arborea* in their accounts; however, neither chose to take up the name and it is considered to represent a *nomen nudum* because of the lack of adequate diagnosis.

**Phenology:** Flowers March to May; fruits April to June.

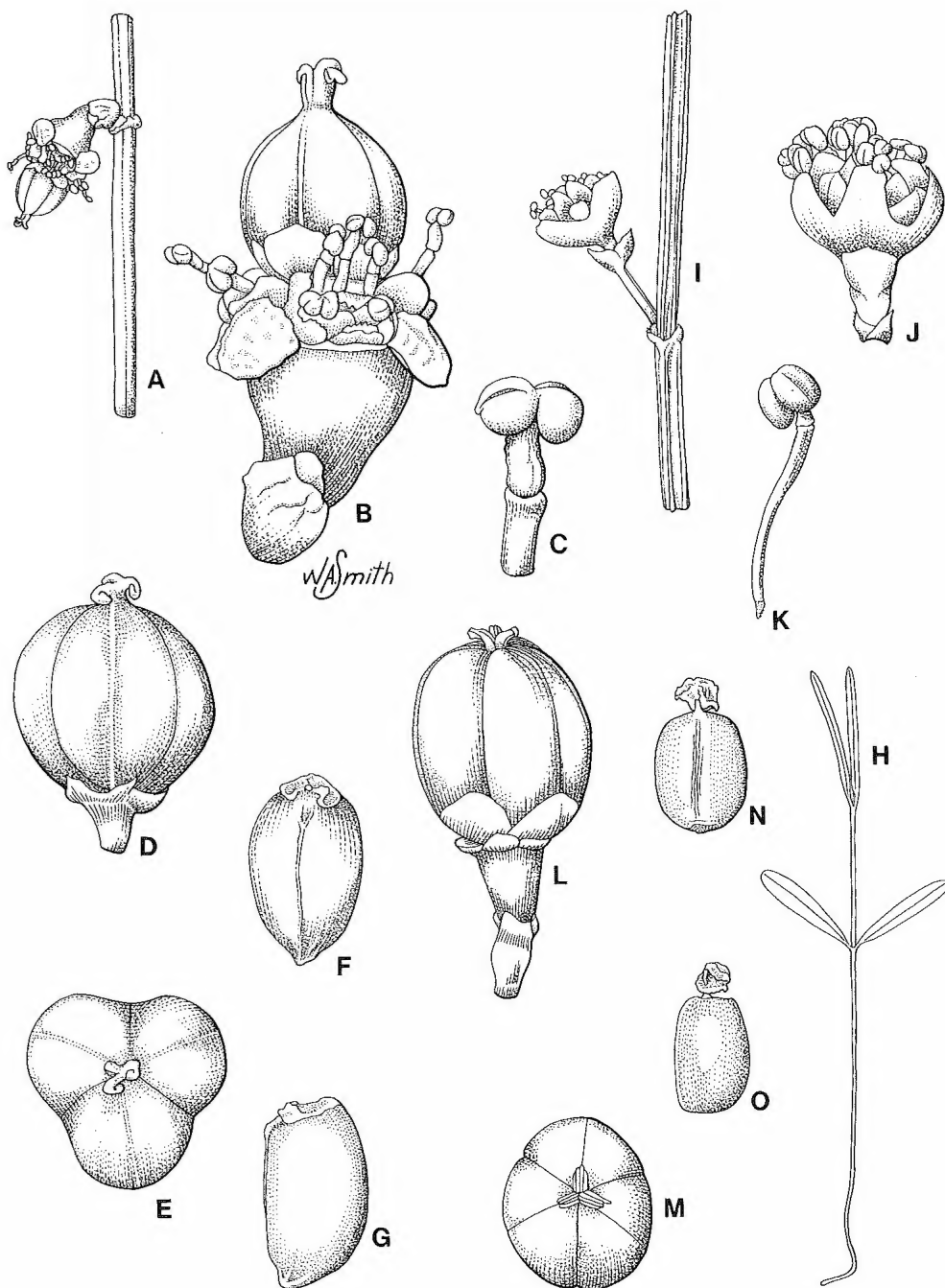
**Conservation status:** Widespread and common. No conservation coding necessary.

**2. *Calycopeplus collinus* P.I. Forst. sp. nov.** affinis *C. casuarinoides* L.S.Sm. a qua in habitu fruticis vel suffruticis breviviventis vel suffrutice usque 2 m alti, cortice laevi, et lobis involucri triangularibus et distincte longioribus majoribusque quam glandes differt. **Typus:** Northern Territory. Headwaters of Liverpool River, Arnhem Land, 12°46'S, 133°44'E, 4 Apr 1984, *G. Wightman* 1433 & *L. Craven* (holo: DNA; iso: BRI, CANB, MEL).

[*Calycopeplus casuarinoides* auct., non L.S.Sm.; Lazarides *et al.* (1988: 13); Dunlop (1989: 35); Wheeler (1992: 596)]

Shrub or subshrub to 2 m high, short-lived (< 5 years). Bark smooth. Stems 6-angular in cross-section, longitudinally ridged; internodes 15–90 mm long, 1–3 mm diameter on upper branches; red 'fruit-like' galls not formed at nodes. Stipules absent. Leaves linear to linear-lanceolate, 1–46 mm long, 0.4–2 mm wide, concolorous, glabrous, eglandular. Inflorescences with peduncles 1.5–3.5 mm long, with 1 or 2 involucre; bracts ovate-triangular, 1–1.5 mm long, 0.7–1.5 mm wide, glabrous. Involucre campanulate, 1.5–3.5 mm long, 1.7–3 mm diameter, glabrous, generally with male and female flowers together in same involucre; lobes triangular, 1–2.2 mm long, 0.8–2 mm wide,





**Fig. 1.** A–H, *Calycopeplus casuarinoides*; I–O, *C. collinus*. A & I, stem with inflorescence A,  $\times 2$ ; I,  $\times 4$ . B & J, inflorescence B,  $\times 6$ ; J,  $\times 8$ . C & K, male flower  $\times 16$ . D & L, side view of fruit D,  $\times 6$ ; L,  $\times 4$ . E & M, apical view of fruit E,  $\times 6$ ; M,  $\times 4$ . F & N, dorsal view of seed F,  $\times 8$ ; N,  $\times 4$ . G & O, ventral view of seed G,  $\times 8$ ; O,  $\times 4$ . H, seedling  $\times 1$ . A–C from Clarkson 8459 (BRI); D–G from Mackenzie [AQ025370] (BRI); H from Forster 13501 *et al.* (BRI); I from Telford 8122 (BRI); J–M from van der Werff 11848 (QRS); N–O from Halford Q1162 (BRI). Del. W. Smith.

entire, longer than glands; glands ellipsoid-spherical, 0.5–1 mm long, 0.5–0.8 mm wide, clearly visible between involucre lobes and inserted on involucre at same level as lobes. Male flowers in clusters of 5–14 flowers; bracts 3, ovate to obovate, 2–3 mm long, 1.8–2 mm wide,  $\pm$  free or somewhat proximally fused, shortly ciliate on tips for 0.2 mm; pedicels filiform, 0.8–2.8 mm long, c. 0.2 mm diameter; filaments filiform, 0.4–0.5 mm long, c. 0.2 mm diameter; anthers 0.4–0.6 mm long, 0.7–0.8 mm wide. Female flowers sessile; perianth segments 5, ovate-oblong, c. 1.8 mm long and 1.8 mm wide, glabrous; ovary sessile, 1.8–2 mm long, 1.8–2 mm wide, glabrous; styles 3, erect to slightly recurved, 1–1.2 mm long, shortly connate for c. 0.2 mm at base; tips distally bifid for c. 0.2 mm of their length. Fruit  $\pm$  obloid, 6–7 mm long, 5–6 mm diameter. Seed oblong, 4–4.5 mm long, 2.2–3.2 mm wide, brown; caruncle hemispherical, 1–1.3 mm long, 1.8–2 mm wide, pale yellow. **Fig. 11–O.**

**Selected specimens examined:** Western Australia. Limestone hills W of Weaber Range, c. 50 km N of Kununurra, c. 13 km NW of Point Springs, Mar 1978, *Lazarides* 8427 (BRI, CANB, PERTH). Northern Territory. 5 miles [8.3 km] W of Rum Bottle Creek, 12°04'S, 133°44'E, Jun 1972, *Maconochie* 1596 (BRI, DNA); 50 km E of Oenpelli, 12°15'S, 133°15'E, Aug 1983, *Wightman* 681 (DNA); gorge between Twin Falls & Jim Jim Falls, 12°19'S, 132°52'E, Mar 1984, *Wightman* 1308 & *Craven* (AD, CANB, DNA); Nabarlek, Arnhem Land, 12°19'S, 133°19'E, Mar 1989, *Hinz* 457 (DNA); Kakadu N.P., 2.5 km NW of Koongarra Saddle, 12°45'S, 132°55'E, *Telford* 8122 & *Wrigley* (BRI, CBG); Upper East Alligator River, Arnhem Land, 12°47'S, 133°21'E, Apr 1988, *Russell-Smith* 5230 & *Lucas* (DNA); west of Koongarra jump-up, 12°51'S, 132°50'E, May 1978, *Rice* 2625 (BRI); near Koongarra Saddle, 1.5 km N of Koongarra, 12°51'S, 132°51'E, May 1980, *Craven* 5716 (CANB, DNA); 6 miles [10 km] S of Yaimanyi Creek, 12°51'S, 134°32'E, Jun 1972, *Byrnes* 2697 (CANB, DNA); Mt Basedow Range, 12°59'S, 132°41'E, Jun 1973, *Hartley* 13895 (CANB, DNA); Kakadu N.P., adjacent to Round Jungle, 13°18'S, 132°38'E, Apr 1987, *Russell-Smith* 2174 & *Lucas* (DNA); Waterfall Creek, above escarpment, 13°19'S, 132°27'E, Apr 1984, *Wightman* 1288 & *Dunlop* (DNA); 1 km upstream from Twin Falls, 13°20'S, 132°42'E, Mar 1988, *Fensham* 871 (DNA); 6 km ESE of Twin Falls, 13°22'S, 132°48'E, May 1980, *Craven* 5846 (CANB, DNA); Kakadu N.P., Birdie Creek, 13°57'S, 132°52'E, Apr 1990, *Cowie* 1108 & *Leach* (DNA, MEL); Katherine Gorge, 15 miles [25 km] E of Katherine township, Mar 1964, *Lazarides* 7029 (CANB, DNA); Katherine Gorge N.P. above Edith Falls, 14°11'S, 132°14'E, Feb 1982, *King* 55 (DNA); Edith Falls, 14°12'S, 132°11'E, Mar 1978, *Reed* 56 (DNA); Eva Valley, 14°20'S, 132°50'E, Apr 1990, *van der Werff* 11848 (QRS).

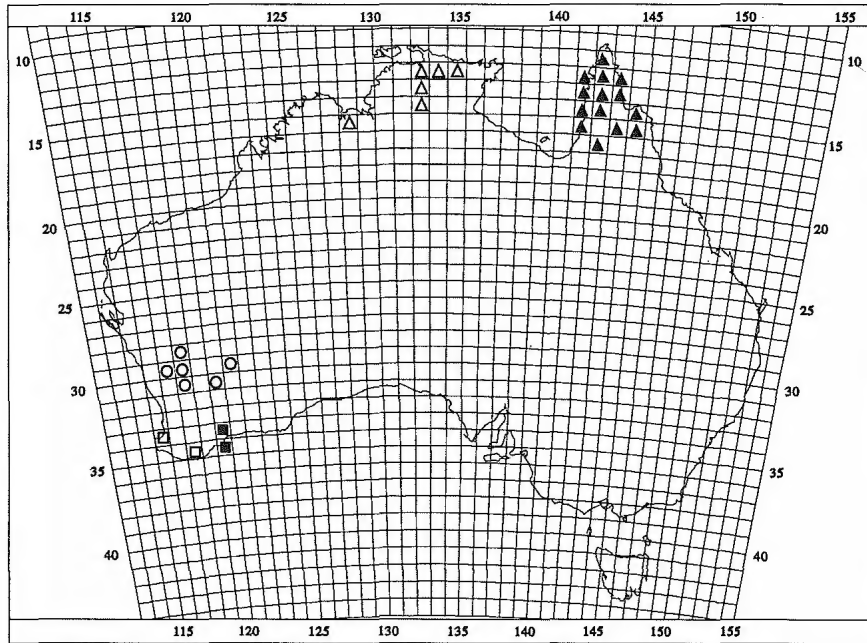
**Distribution and habitat:** GRIDCELLS: 12132, 12133, 12134, 13132, 14132, 15128. *C. collinus* occurs in monsoonal Northern Territory and from a single disjunct record in the Western Australian Kimberley (**Map 1**). In the Northern Territory, plants grow on or associated with the extensive sandstone escarpments that are widespread in eastern Arnhem Land. The major vegetation type from which the species is recorded is low open eucalypt woodland dominated by species such as *E. phoenicea* F. Muell. or *E. miniata* A. Cunn. ex Schauer, and with spinifex (*Triodia* spp.) dominant in the understorey. The single collection from Western Australia is recorded from a limestone gorge in association with *Eucalyptus cliftoniana* W. Fitzg. ex Maiden, *Grevillea* sp. and *Triodia* sp.

**Notes:** *C. collinus* has previously been included in *C. casuarinoides* and the numerous collections from the Northern Territory have been widely distributed under the name *C. casuarinoides*. The most obvious macroscopic difference between *C. casuarinoides* and *C. collinus* is habit. *C. casuarinoides* is a long-lived small tree to 10 m in height that develops a prominent black, fissured bark with age. *C. collinus* is a relatively short-lived (2–3 years apparently) subshrub or shrub to 2 m in height that does not develop fissured bark. Flowering material of the two species is also easily distinguishable as *C. collinus* has involucre with lobes markedly longer and larger than the glands, whereas with *C. casuarinoides* the situation is reversed. In addition, the habitats where the two occur could not be more dissimilar, escarpments for *C. collinus* and seasonal swamps for *C. casuarinoides*.

**Phenology:** Flowers January to July; fruits January to August.

**Conservation status:** *C. collinus* is common and relatively widespread in the Northern Territory where most of the populations are present in Kakadu National Park. The status of the single known Western Australian population has yet to be determined.

**Etymology:** The specific epithet is derived from the Latin *collinus* (hills) and alludes to the preference of this species for escarpment habitats.



Map 1. *Calycopeplus collinus*  $\Delta$ , *C. casuarinoides*  $\blacktriangle$ , *C. marginatus*  $\blacksquare$ , *C. oligandrus*  $\square$ , *C. paucifolius*  $\circ$ .

**3. *Calycopeplus paucifolius* (Klotzsch) Baill.**, *Adansonia* 6: 319 (1866); *Euphorbia paucifolia* Klotzsch in Lehmann, *Pl. Preiss.* 1: 174 (1845). **Type:** Western Australia. ad riparim fluvii Canning, 2 Nov 1839, L. Preiss 1208 (iso: LD).

*Calycopeplus ephedroides* Planch., *Bull. Soc. Bot. France* 8: 31 (1861). **Type:** Western Australia. Swan River, Drummond (holo: K; iso: K n.v. [photo at BRI]).

*Calycopeplus helmsii* F. Muell. & Tate, *Trans. Proc. Roy. Soc. S. Aust.* 16: 341 (1896), **synon. nov.** **Type:** Western Australia. 36 miles [50 km] N.W. from Southern Cross, 26 Nov 1891, R. Helms [AD96832137] (holo: AD; iso: NSW).

Illustration: Boissier (1866, t. 120).

Shrub or subshrub to 1.5 m high, lifespan unknown. Bark smooth. Stems round in cross-section, longitudinally cylindrical; internodes 20–90 mm long, 1.5–5 mm diameter on upper branches; red 'fruit-like' galls not formed at nodes. Stipules absent. Leaves linear, 5–25 mm long, 0.7–0.9 mm wide, concolorous, glabrous,

with 1 or 2 small sessile glands per side of midrib on the margins 2–7 mm from the base. Inflorescences with peduncles 1–2 mm long, with 1 or rarely 2 involucre; bracts lanceolate-ovate, c. 3 mm long, 2–2.8 mm wide, glabrous. Involucres broad-campanulate, 2–3 mm long, 4.5–5 mm diameter, glabrous, generally with male and female flowers in separate involucre; lobes triangular-truncate, 1.5–2.5 mm long, 2.6–3.2 mm wide, entire, longer than glands; glands ellipsoid-spherical, 0.8–1.2 mm long, 0.9–1.3 mm wide, clearly visible between involucre lobes and inserted on involucre at same level as lobes. Male flowers in clusters of 3–7 flowers; bracts 3, ovate to obovate, 2–3.5 mm long, 2–2.5 mm wide,  $\pm$  free or somewhat fused proximally, glabrous; pedicels filiform, 2–3.5 mm long, c. 0.4 mm diameter; filaments filiform, 0.5–0.7 mm long, c. 0.4 mm diameter; anthers 1.4–1.5 mm long, c. 1.8 mm wide. Female flowers sessile or shortly pedicellate with pedicels up to 1.8 mm long; perianth segments 5, triangular, 2–2.5 mm long, 2.8–3 mm wide, glabrous; ovary sessile, 3.5–4 mm long, c. 3 mm wide, glabrous; styles 3, erect to slightly recurved, 0.6–0.8 mm long, connate for c. 0.4 mm at base; tips distally bifid for 0.1 mm long. Fruit globose-obloid, 6–8 mm

long, 6–6.6 mm diameter. Seed obloid, 3.5–4.6 mm long, 2.3–2.5 mm wide, tan-grey; caruncle hemispherical, c. 1 mm long and 1.5 mm wide, pale yellow. **Fig. 2G–M.**

**Additional specimens examined: Western Australia.** 40 km N of Paynes Find on the Mt Magnet road, 28°58'S, 117°48'E, Oct 1981, *Craven* 7139 (AD, BRI, CANB); 54.3 miles [90.5 km] N of Wubin towards Paynes Find, Oct 1966, *Lullfitz* 5720 (PERTH); 5.6 km W of Yalgoo turnoff from Paynes Find, 29°12'S, 117°39'E, Nov 1977, *Chinnock* 4025 (AD); 8 km W of Great Northern Highway on Paynes Find - Fields Find road, Nov 1987, *Green* 5247 (CANB); Mt Churchman, Sep 1970, *Ashby* 3594 (AD, PERTH); 21.1 km E along Mt Gibson Homestead road off Wubin - Paynes Find road, 29°34'S, 117°18'E, Aug 1976, *Coveny* 7890 & *Maslin* (NSW); Helena River, Nov 1902, *Fitzgerald* s.n. (NSW); Helena Valley, Nov 1977, *Seabrook* 272 (CANB); 6 km NNW of Scorpion Rock, Walling Rock Station, 29°46'S, 120°17'E, Nov 1988, *Cranfield* 7455 (CANB); Hospital Rocks on Menzies to Dielmals road, 29°50'S, 120°07'E, Oct 1984, *Corrick* 9143 (MEL); Hospital Rock, 30 miles [50 km] W of Riverina, Sep 1973, *Beard* 6520 (NSW); 1 mile [1.6 km] S of Mt Stephen, Nov 1963, *Brown* [PERTH02756013] (PERTH); Koolanook Hills, Sep 1931, *Gardner* 2672 (PERTH).

**Distribution and habitat:** GRIDCELLS: 28117, 29116, 29117, 29119, 30117, 30119. *C. paucifolius* occurs in the southwest of Western Australia in the Murchison Region (**Map 1**). There are no records from South Australia (Weber 1986) and the species should be deleted from the flora of that State.

The type of *Euphorbia paucifolia* Klotzsch is purportedly from the Canning River in suburban Perth (cf. Marchant 1990); however, there are no recent collections of the taxon from this region which suggests that the recorded locality is probably suspect. Wheeler (1987) noted a single record from the Helena Valley (based on an old Fitzgerald collection at PERTH); however, there is one more recent collection from the area (see *Seabrook* 272 above) and further exploration is required in that area to localise the population(s).

*C. paucifolius* grows on granite rock outcrops where there are large areas of exposed bare-rock slabs alternating with *Casuarina campestris* Diels thickets (Beard 1990). According to Beard (1990), *C. paucifolius* is common in the more open areas of thicket, often associated with *Calothamnus gilesii* F. Muell.

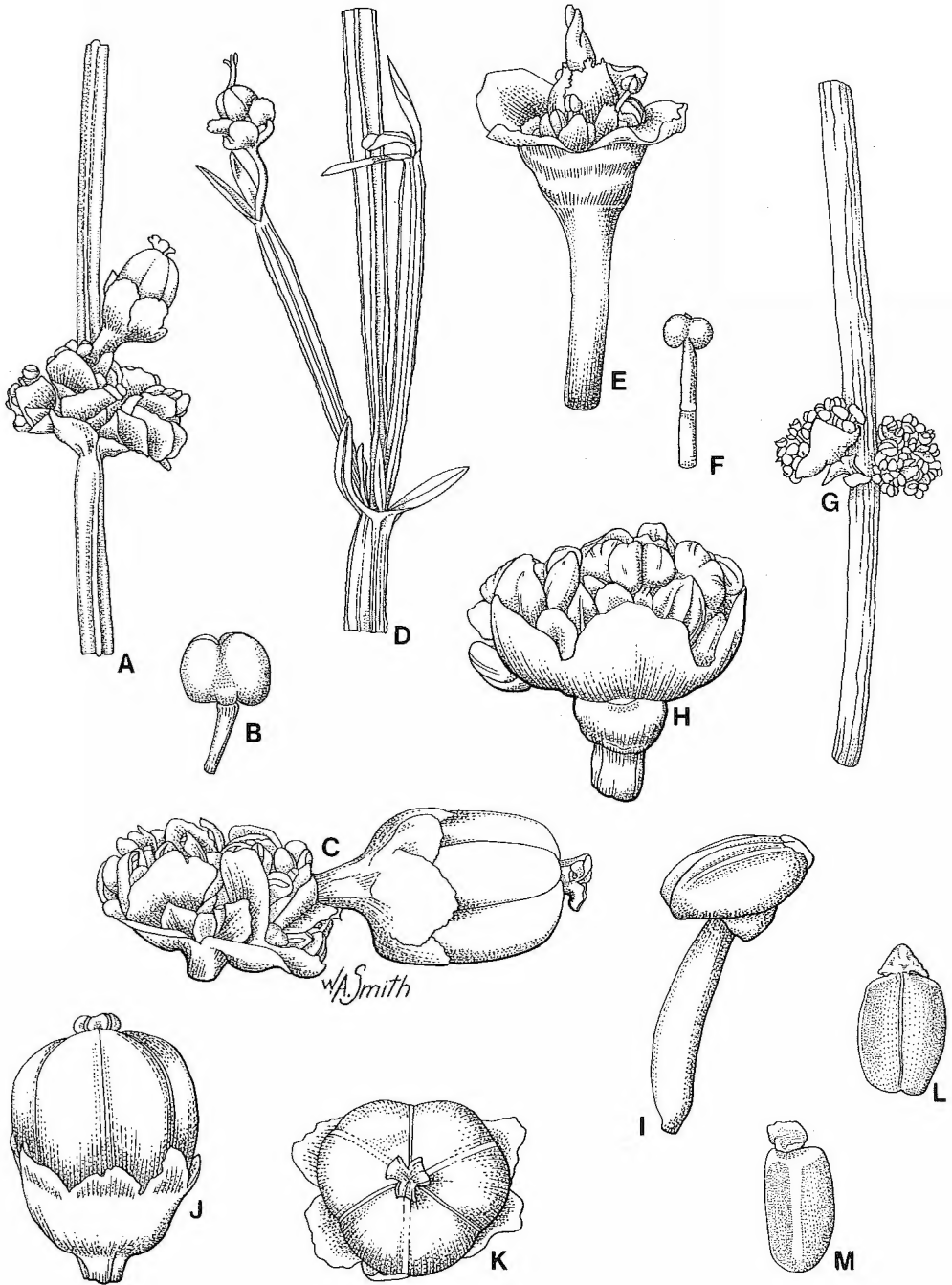
**Notes:** *C. paucifolius* is the only species of the genus with cylindrical stems. Weber (1986) recognised that *C. paucifolius* was conspecific with *C. ephedroides*; however, *C. helmsii* is newly reduced to synonymy of *C. paucifolius* in this paper.

**Phenology:** Flowers September to November; fruits September to December.

**Conservation status:** There are relatively few collections of this plant from a wide area, with most collections from the vicinity of Paynes Find. Even so, Hopper *et al.* (1990) did not consider this plant as rare or threatened.

**4. Calycopeplus marginatus** Benth., Fl. Austral. 6: 53 (1873). **Type:** Western Australia. Towards Cape Riche [Cape Riche is c. 34°37'S, 118°47'E], *Drummond*, 5th Coll. n. 213. (holo: K; iso: K n.v. [photo at BRI], PERTH).

Shrub or subshrub to 4 m high, lifespan unknown. Bark smooth. Stems 2-angular in cross-section, longitudinally complanate; internodes 10–105 mm long, 1.5–5 mm diameter on upper branches; red 'fruit-like' galls not formed at nodes. Stipules linear-lanceolate, 0.4–1 mm long, 0.1–0.2 mm wide, glabrous or with a few marginal cilia. Leaves linear-lanceolate, 0.4–1 mm long, 0.1–0.2 mm wide, concolorous, glabrous, eglandular. Inflorescences with peduncles 2–15 mm long, generally with 1 involucre; bracts lanceolate-ovate to obovate, 1–1.2 mm long, 0.4–0.5 mm wide, glabrous. Involucres broad-campanulate, 1.2–1.5 mm long, 2.2–3 mm diameter, glabrous, generally with male and female flowers together in the one involucre; lobes obovate to ovate, 1.5–2.2 mm long, 1.5–2.4 mm wide, entire, longer than glands; glands ellipsoid to triangular, 0.3–0.4 mm long, 0.4–0.5 mm wide, obscured by involucre lobes and inserted on involucre at base below lobe insertion. Male flowers in clusters of 4–12 flowers; bracts 3, obovate, 1.3–3 mm long, 1–2.5 mm wide, ± free or somewhat fused proximally, shortly serrate on tips for c. 0.4 mm; pedicels filiform, 0.5–0.8 mm long, c. 0.2 mm diameter; filaments filiform, 0.5–1.5 mm long, c. 0.2 mm diameter; anthers 0.3–0.5 mm long,



**Fig. 2.** A–C. *Calycopeplus oligandrus*; D–F. *C. marginatus*; G–M. *C. paucifolius*. A, D, G. stem with inflorescence A,  $\times 8$ ; D,  $\times 4$ ; G,  $\times 4$ . B, F, I. male flower  $\times 24$ . C, E, H. inflorescence  $\times 12$ . J. side view of fruit  $\times 8$ . K. apical view of fruit  $\times 8$ . L. dorsal view of seed  $\times 8$ . M. ventral view of seed  $\times 8$ . A–C from *White 5335* [AQ201809] (BRI); D–F from *Gardner* (PERTH01079018); G–M from *Craven 7139* (BRI). Del. W. Smith.

0.4–0.5 mm wide. Female flowers sessile; perianth segments 4, obovate, 2–3 mm long, 1.5–1.8 mm wide, shortly serrate to 0.4 mm; ovary sessile, 1.6–2 mm long, 1.3–1.5 mm wide, glabrous; styles 2 or 3, erect, 1.5–2 mm long, connate for 1.5–2 mm at base; tips distally bifid for c. 0.4 mm long. Fruit ± globose, 4–5 mm long, 4.5–5 mm diameter. Seed obloid, c. 3 mm long and 2.5 mm wide, brown-orange; caruncle hemispherical, c. 1 mm long and 1.4 mm wide, cream-yellow. **Fig. 2D–F.**

**Additional specimens examined: Western Australia.** Between Hamersley River estuary & East Mt Barren, Oct 1970, *Maslin* 914 (PERTH); Thumb Peak, Fitzgerald N.P., Oct 1970, *Royce* 9264 (PERTH); Fitzgerald River Reserve, western edge of main valley, Jul 1970, *Royce* 8896 (CANB, PERTH); Thumb Peak Range, Oct 1965, *George* 7165 (PERTH); Summit of mid Mt Barren Range, SW of Ravensthorpe, Sep 1925, *Gardner* [PERTH01079018] (PERTH); Fitzgerald River, Sep 1948, *Gardner* 9219 (PERTH); Fitzgerald River Flat, Sep 1970, *Aplin* 3582 (PERTH); Fitzgerald River area, c. 70 miles [112.7 km] ESE of Ongerup, Sep 1970, *Aplin et al.* 3201 (NSW).

**Distribution and habitat:** GRIDCELLS: 33119, 34119. *C. marginatus* is restricted to two 1° grid cells in the south-west of Western Australia and is particularly well known from the Fitzgerald River area (**Map 1**). Plants have been recorded as growing in white sand or red loam, often near watercourses, but recorded ecological information is otherwise scant.

**Notes:** *C. marginatus* is distinctive within the genus by virtue of the complanate, 2-winged stems and the different form of insertion of the involucre gland.

**Conservation status:** *C. marginatus* occurs in a restricted area; however, it is present in the Fitzgerald National Park. Hopper *et al.* (1990) listed the species as “Priority Three...(those taxa with several poorly known populations, some on conservation lands)” in their assessment of the conservation status of the Western Australian flora. An appropriate conservation coding, therefore, is 2RC.

**5. Calycopeplus oligandrus** P.I.Forst., **sp. nov.** affinis *C. paucifolio* (Klotzsch) Baill. a qua involucris brevioribus (c. 1.8 mm longis) lobis late triangularibus brevioribus (0.8–1 mm longis) et glandibus minoribus (c. 0.4 × 0.5 mm); staminibus filamentis

longioribus et tenuioribus (1.6–1.8 × c. 0.2 mm), et antheris minoribus (0.7–0.9 × c. 1 mm) differt. **Typus:** Western Australia, road between Youngs siding and Denmark, Denmark Railway, 6 Nov 1927, *C.T. White* 5335 [AQ201809] (holo: BRI [1 sheet]).

Shrub or subshrub to 3 m high, lifespan unknown. Bark smooth. Stems 6-angular in cross-section, longitudinally ridged; internodes 15–100 mm long, 1–3 mm diameter on upper branches; red ‘fruit-like’ galls not formed at nodes. Stipules absent. Leaves linear, 7–25 mm long, c. 1 mm wide, concolorous, glabrous, eglandular. Inflorescences with peduncles up to 1.5 mm long, with 2 involucre; bracts broadly-triangular, c. 2 mm long and 2.4 mm wide, glabrous. Involucre broad-campanulate, c. 1.8 mm long and 2.8 mm diameter, glabrous, generally with male and female flowers together in each involucre; lobes broad-triangular, 0.8–1 mm long, c. 2 mm wide, entire, longer than glands; glands ellipsoid-spherical, c. 0.4 mm long and 0.5 mm wide, clearly visible between involucre lobes and inserted on involucre at same level as lobes. Male flowers in clusters of 2 or 3 flowers; bracts 3, obovate, 1.5–1.6 mm long, 0.8–1 mm wide, ± free or somewhat fused, shortly ciliate on tips for 0.2 mm; pedicels filiform-terete, 1.6–1.8 mm long and 0.2 mm diameter; filaments filiform-terete, c. 0.7 mm long and 0.4 mm diameter; anthers 0.7–0.9 mm long, c. 1 mm wide. Female flowers sessile; perianth segments 5, ovate, c. 2 mm long and 1.8 mm wide, glabrous; ovary sessile, c. 1.5 mm long and 1.4 mm wide, glabrous; styles 3, ± erect, c. 0.4 mm long, connate for c. 0.3 mm at base; tips distally bifid for 0.1 mm long. Fruit obloid, c. 4 mm long and 3 mm diameter. Seed not seen. **Fig. 2A–C.**

**Additional specimens examined: Western Australia:** Busselton district, Dec 1963, *Royce* 7813 (PERTH); Abba River, Busselton district, Oct 1953, *Royce* 4576 (PERTH); Hay River, c. 26 miles W of Albany, Jul 1953, *Melville* 4455 & *Royce* (PERTH).

**Distribution and habitat:** GRIDCELLS: 33115, 34117. *C. oligandrus* is known from a small number of collections in the south-west of Western Australia (**Map 1**). The habitat of this plant has been recorded as “Paperbark swamp by riverbank” (label data of *Melville* 4455 & *Royce*).



**Notes:** There are three collections by C.T. White at BRI numbered as 5335. All are from south-west Western Australia and come from different localities, collected on different dates and pertain to different taxa. This numbering inconsistency is apparently common with White's earlier collections. Despite this, there should be little doubt as to the locality where this plant occurs, as White collected other plants on the same day (and adjacent days) from the Denmark area. Collectors familiar with this area should localise the type locality further and perhaps collect more of this plant.

*C. oligandrus* is a distinctive species within the genus by virtue of its very small involucre with few-flowered male flower clusters.

**Conservation status:** The last collection of this plant is from 1963 and further survey work is required to ascertain its current localities. An appropriate conservation coding is 1K.

**Etymology:** The specific epithet is derived from Greek *oligo* (few) and *andrus* (stamens) and alludes to the small number of male flowers within the involucre in this species.

### Acknowledgements

The illustrations and map were prepared by W. Smith (BRI). Field studies of *C. casuarinodes* were possible with the assistance of D. & I. Liddle, G. & N. Sankowsky and M.C. Tucker. The Directors/Curators of the cited herbaria allowed access to specimens either on loan or *in situ*. A.S. George located additional specimens of some taxa in PERTH. Translation of the diagnoses into Latin was undertaken by L.A. Craven (CANB). Comments on a draft of the manuscript were provided by A.R. Bean (BRI). This work was wholly supported by grants to the author from the Australian Biological Resources Study during 1992–1994.

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